



भारतीय प्रौद्योगिकी संस्थान कानपुर
Indian Institute of Technology Kanpur

MECHANICAL ENGINEERING

POST GRADUATE PROGRAM

Website: www.iitk.ac.in/ime/

MECHANICAL ENGINEERING

Welcome to the Department of Mechanical Engineering at IIT Kanpur.

Over the last six decades, we have grown our expertise and competence in the core Mechanical Engineering curriculum and research. We have a strong undergraduate program, including a B. Tech. – M. Tech. dual degree program. At the postgraduate level, we offer M. Tech., MS by Research and Ph.D. degrees. At present, the department has over 180 PhD scholars. Several sponsored candidates from industries, national research laboratories, and defence forces undertake PG studies with us. Besides this, our department hosts several postdoctoral fellows also.

We offer a robust science-based engineering curriculum, primarily focusing on imparting the latest technical know-how to students, problem-solving skills, innovation, and entrepreneurship. We offer a large number of optional courses, thereby providing a broad spectrum to the students to pursue their interests. The course contents are periodically updated to introduce new scientific and technological developments. Undergraduate students are also encouraged to undertake various research projects.

We are committed to contributing to solving the contemporary technological challenges of society. We have active research groups in Solid Mechanics, Design, Thermal and Fluid Sciences, Manufacturing Sciences, Robotics and Automation, for carrying out collaborative and interdisciplinary research. State-of-the-art research facilities support our academic programs and research. Funding from sponsored research and consultancy projects helps us to maintain and modernize our research infrastructure.

Our department has a distinguished record in both teaching and research. The faculty members have been conferred many prestigious national and international awards. They also serve on the editorial boards of national and international journals and regularly organize international symposia and conferences.

This brochure provides an overview of the academic programs and research activities, infrastructural facilities, and profiles of faculty members. If you have further questions, please do not hesitate to contact us. Thank you for your interest in our department.



POST-GRADUATE PROGRAMMES OFFERED

- ❖ Ph. D. Program in Mechanical Engineering
- ❖ M. Tech. Program, with specialization in
 - I. Solid Mechanics and Design
 - II. Fluid and Thermal Sciences
 - III. Manufacturing Science and Engineering
 - IV. Robotics and Automation.
- ❖ MS (Research) Program in all four specialization streams, as above

LABS/FACILITIES

- ❖ Applied Solid Mechanics
 - ❖ Additive Manufacturing
 - ❖ Combustion and Energy Conversion Systems
 - ❖ Compliant and Robotics
 - ❖ Computational Manufacturing
 - ❖ Computational Mechanics
 - ❖ Computational Turbomachinery
 - ❖ Divyadrishti
 - ❖ Energy Conversion & Storage
 - ❖ Engine Research
 - ❖ Experimental Fluid Mechanics
 - ❖ Gas Turbine Heat Transfer
 - ❖ High-speed Experimental Mechanics
 - ❖ Micro Systems Fabrication
 - ❖ Non-destructive testing
 - ❖ Nonlinear Mechanics
 - ❖ Phase-Change Thermal Systems
 - ❖ Robotics
 - ❖ Smart Materials, Structures and Systems
 - ❖ Tribology and Surface Engineering
 - ❖ Turbomachinery
 - ❖ Water Tunnel Facility
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FACULTY LIST

- Agarwal Avinash K, Ph.D. (IIT Delhi): IC Engines, Alternate fuels, Emissions, Laser diagnostic Techniques, Micro-sensor development, Lubricating Oil Tribology, Nano-particulates.
- Basu Sumit, Ph.D. (IISc Bangalore): Computational micromechanics, Fracture mechanics, Modeling of Materials across Length Scales, Finite Deformation Theories and Nonlinear FEM.
- Bhattacharya B, Ph.D. (IISc Bangalore): Smart structures, Active and passive vibration control, Flexible manipulators and smart compliant joints, Active shape control and adaptive structures.
- Bhattacharya J, Ph.D. (University of Michigan): Thermodynamics, Heat transfer, Energy storage materials, Atomic-scale computation, Multi-scale modelling.
- Bhattacharya S, Ph.D. (University of Missouri): Bio MEMS, Lab-on-chip, Nanotechnology, Microsystems fabrication, Microfluidics, Lithography processes, Nanoenergetics.
- Biswas G, Ph.D. (IITK haragpur): Computational fluid mechanics, Heat transfer, Turbulence.
- Chandraprakash C, Ph.D. (Penn State University): Acoustic metamaterials, Thermal non-destructive evaluation, Biomimetic soft robots, Computer vision Multifunctional thin films.
- ChatterjeeAnindya, Ph.D. (Cornell University): Dynamics and Vibrations.
- Dasgupta Bhaskar, Ph.D. (IISc Bangalore): Robotics, CAD, Mechanisms, Machine dynamics, Optimization.
- Das Malay K, Ph.D. (Penn State University): Electrochemical energy conversion, Chemically reacting systems.
- De Santanu, Ph.D. (IISc Bangalore): Numerical simulation of turbulent reactive flows; Laser-based optical diagnostics; Spray combustion; Gas turbine combustion; Clean coal technology
- Dutta Ashish, Ph.D. (Akita, Japan): Robotics, Intelligent control systems, Microsensors and actuators, Bio-robotics.
- Ghoshdastidar P S, Ph.D. (University of South Carolina): Computational heat transfer, Rotary kiln modelling, Non-Newtonian flow and heat transfer, Simulation of boiling heat transfer, Modelling of microscale and nanofluids heat transfer, Food drying and chilling.
- Gopalakrishnan Shyam Sunder, Ph.D. (Ecole Centrale de Lyon): Instabilities in hydrodynamics, Biological fluid flows, Porous media flows, Nonlinear optics, Out-of-equilibrium systems.
- Gupta A, Ph.D. (University of Berkeley): Dynamics of defects in solids, Waves in solids, Mechanics of thin films.
- Gupta Shakti S, Ph.D. (Virginia Tech): Linear/nonlinear structural mechanics, Mechanics of nanomaterials, Characterization using molecular simulations.
- GuruprasadK R, Ph.D. (IISc Bangalore): Robotics-Mechanics and Control, Motion Planning, Multi Robots Systems, Cooperative Control, Exo-Skeleton Control, Voronoi Partition and its Applications.
- Joshi Pranav, Ph.D. (Johns Hopkins University): Experimental fluid mechanics, Turbulent flows, Heat transfer
- Kar Kamal K, Ph.D. (IITK haragpur): Polymer, Polymer blends, Alloys, Composites, Polymer processing, Rheology

FACULTY LIST

- Kumar Arvind, Ph.D. (IISc Bangalore): Solidification processing; Heat transfer in manufacturing; Additive manufacturing; Laser materials processing; Thermal energy storage; Thermal spray coating.
- Kumar Virkeshwar, Ph.D. (IIT Bombay): Solidification, Casting, Transport phenomena, Natural convection, Evaporation, Flow visualization.
- Law Mohit, Ph.D. (UBC Vancouver): Machine tool dynamics, Vibration control, Dynamic sub structuring, High-performance machining.
- Madanan Umesh, Ph.D. (University of Minnesota): Heat and mass transfer analogy, Flow and heat transfer under natural convection, Gas turbine heat transfer, Pool boiling.
- Mimani Akhilesh, Ph.D. (IISc Bangalore): Array processing methods for acoustic source localization, Computational acoustics and aeroacoustics, Duct and muffler acoustics, Mechanical vibration.
- Mishra Sarvesh, Ph.D. (IIT Delhi): Manufacturing sciences, hybrid manufacturing, surface engineering.
- Mukherjee Dipayan, Ph.D. (Ecole Polytechnique): Solid mechanics, Electro/Magneto-mechanics, Ion conducting solids, Instabilities, Mechanics of smart slender structures, Numerical homogenization, Computational mechanics.
- Mukhopadhyay Supratik, Ph.D. (University of Bristol): Mechanics of composites, Theory of Damage and failure, Numerical simulation of strain localization and fracture, Finite element method, Mesh-independent and meshfree methods, Numerical simulation.
- Muralidhar K, Ph.D. (University of Delaware): Optical techniques, Flow control, hierarchical transport phenomena, biological flows.
- Pal Anikesh, Ph.D. (University of California San Diego): Turbulence, Machine learning, Computational fluid dynamics, Atmospheric and oceanic flows and climate dynamics.
- Panigrahi Pradipta K, Ph.D. (Louisiana State University): Laser-based instrumentation, Flow control, CAD of thermal systems, Turbulence, Microfluidics and heat transfer.
- Ramani Keval S., Ph.D. (University of Michigan): Dynamic Systems and Control, Additive Manufacturing, Robotics, Automation.
- Ramkumar J, Ph.D. (IIT Madras): Micro/nano-Fabrication& finishing, Nanocomposites & Tribology.
- Roy Ushasi, Ph.D. (Georgia Institute of Technology): Solid mechanics, Fracture mechanics, Plasticity, FEM, Microstructure-property correlation, Multiscale and multi-physics modelling of deformation and fracture.
- Saha Arun K, Ph.D. (IIT Kanpur): Turbulence, chaos & bifurcation, Vortex dynamics, Hotwire anemometry, Gas hydrates, Experimental fluid dynamics and heat transfer, Computational fluid dynamics and heat transfer.
- Sarkar Abhishek, Ph.D. (Iowa State): Energy-dense electrode materials, Nanomaterial synthesis, Magnetic-electrochemical interactions, Electrodeposition, corrosion, Lithium battery, Battery recycling, Laser-assisted synthesis, Additive manufacturing, Modeling of energy storage systems.
- Sarkar Subrata, Ph.D. (IIT Madras): Turbomachinery, Fluid mechanics, Computational fluid flows, Turbulence, LES/DNS and Heat transfer.
- Saurabh Aditya, Ph.D. (Technical University, Berlin): Dynamics of gas turbine (GT) combustors, Flame dynamics, Atomization of liquid fuels, Alternative and biofuels in GT engines, Suppression of noise and instabilities in combustors

FACULTY LIST

- Saxena Anupam, Ph.D. (University of Pennsylvania): Compliant mechanisms, Topology design, CAD, Robotics, MEMs, Optimization, Large deformation systems.
- Sharma Basant L, Ph.D. (Cornell University): Continuum mechanics and thermodynamics, Lattice dynamics, Dislocations, and solid-solid phase transformation.
- Sharma Ishan, Ph.D. (Cornell University): Fluid/solid mechanics; Contact mechanics; Granular media; Planetary/Space science; Waves and instabilities in continua; Fluid-structure interaction.
- Shinde Sachin Y, Ph.D. (IISc Bangalore): Experimental fluid mechanics, Biofluid dynamics, Swimming and flying, Fluid-structure interaction.
- Sikroria Tushar, PhD, (University of Melbourne): Turbulent compressible flows, multiphase flows, aero-acoustics, experimental flow diagnostics, gas turbine and sustainable energy systems
- Singh Manjesh K, Ph.D. (ETH Zurich): Soft matter, tribology, rheology.
- Sinha Niraj, Ph.D. (University of Waterloo): Nanotechnology, Bioengineering, Manufacturing Systems.
- Tiwari Nachiketa, Ph.D. (Virginia Tech.): Acoustics and noise control, Solid mechanics, Composite structures, Vibrations, Product design, Automotive systems, MEMS.
- Venkitanarayanan P, Ph.D. (University of Rhode Island): Experimental solid mechanics, Dynamic fracture mechanics, Functionally graded composites.
- Vyas Nalinaksh S, Ph.D. (IIT Delhi): Micro-electro-mechanical system (MEMS), Vibrations and control, Rotor dynamics, Instrumentation, Condition monitoring.
- Wahi P, Ph.D. (IISc Bangalore): Nonlinear dynamics, Vibration.



BROAD RESEARCH AREAS

- Thermal and Fluid Science
 - Computational fluid dynamics and heat transfer
 - Conventional and alternate energy conversion
 - Experimental techniques in fluid and thermal systems
 - Thermal and thermochemical energy storage
 - Transport phenomena and multiphysics simulations

 - Manufacturing Science
 - Non-conventional manufacturing
 - Nano and micro-fabrication
 - Machine tool dynamics and control
 - Additive manufacturing
 - Directional Solidification, and Welding
 - Modelling in the manufacturing system

 - Robotics and Automation
 - Intelligent gripper design
 - Robot-child interaction
 - Humanoid and Bio-robotics
 - Micro-sensors and actuators
 - Exoskeleton and neuro-rehabilitation

 - Solid Mechanics and Design
 - Multi-scale modeling
 - Non-linear mechanics
 - Vibrations and acoustics
 - CAD and Optimization
 - Smart materials
 - Tribology
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ADDITIONAL DEPARTMENT SPECIFIC INFORMATION

Mechanical Engineering offers M.Tech., MS(Research), and Ph.D. programs. Faculty members are associated with four broad streams: Solid Mechanics and Design (SMD); Fluid Mechanics and Thermal Sciences (FTS); Manufacturing Science (MFS); and Robotics and Automation (RA).

M.Tech. Program: This program emphasizes developing a broad background in a particular stream, followed by a deeper study of a problem in the stream. Every student takes a minimum of 8 courses, of which 3 or 4 (depending on the stream) are compulsory courses. In the second semester, the student mostly takes the elective and the remaining compulsory courses, if any. The elective courses are chosen in consultation with the thesis supervisor to match the student's interest and thesis requirements. The third and fourth semesters are dedicated to thesis work.

The minimum qualification for admission to the M.Tech. program in different streams is a Bachelor's degree in Mechanical Engineering or in any of the following branches for different streams.

- **Manufacturing Sciences:** Aerospace Engineering, Chemical Engineering, Metallurgy/Material Science and Engineering, Production/Manufacturing Engineering.
- **Fluid and Thermal Sciences:** Aerospace Engineering, Chemical Engineering.
- **Solid Mechanics and Design:** Aerospace Engineering, Civil Engineering, Metallurgy/Material Science and Engineering, Chemical Engineering.
- **Robotics and Automation:** Aerospace Engineering, Computer Science, Electrical/Electronics/Communication Engineering, Mechatronics / Instrumentation Engineering.

At the time of admission, the candidates are ranked according to merit depending on their previous educational background, GATE score, and their performance in the interview/written test. The stream is allotted according to the rank, eligibility (as above) and the preference of the candidate.

Ph.D. Program: The required qualification for admission to the Ph.D. program is a Master's degree in Mechanical Engineering*. Candidates with B.Tech. (Mechanical)* having a valid GATE score 'are also considered for the direct Ph.D. program. The GATE score requirement is waived for final year B.Tech. Degree students of Centrally Funded Technical Institutes (CFTI). In exceptional cases, Master's degree in other branches of engineering and M.Sc. are also considered with minimum percentage/CPI specified by the department/Institute. Interview/written test are conducted by the department and the admissions will be made as per the procedure detailed at <http://www.iitk.ac.in/me/>.

The doctoral program is designed to equip the student with general proficiency in a stream through the course work. The student then proceeds to do a fundamental creative investigation of a topic in the stream. A Ph.D. student is required to take a minimum of 6 courses, while a direct Ph.D. student has to 10 courses for direct Ph.D. students. After completion of the course work and before proceeding to the thesis work, he/she is required to pass the comprehensive examination.

ADDITIONAL DEPARTMENT SPECIFIC INFORMATION

This examination has written and oral parts and is designed to judge the overall comprehension of the student in his/her field.

M.S. (Research)Program: In this program, the emphasis is on the development of a broad background in a particular stream followed by a deeper study of a problem in the stream. The research component is more than that in an M. Tech program. Candidates with B.Tech. in Mechanical Engineering with 55% marks / 5.5 CPI, and a valid GATE Score (to be waived for candidates working in sponsored projects). B.Tech. in some other branches of Engineering may also be considered.

The minimum course requirements for this program will be five, including two compulsory courses. Mathematics for Engineers is compulsory for all students. The other compulsory course will be stream specific. The minimum research credit for the MS by research program will be 72 credits. The remaining credits have to be obtained either from the course or research works.

The candidates not working in sponsored projects and admitted on a full-time basis will be required to have a valid GATE score (unless they have graduated from an IIT with a minimum CPI of 8.0). Some of them may be offered Institute or Project Assistantships, as in the case of the M.Tech. students.

The candidates working in sponsored projects and admitted on a full-time basis and the students admitted on part-time basis (with a minimum of one year of project support from the date of admission) will not be required to satisfy the GATE requirement. The part-time students employed in sponsored research projects in the Institute will have to get project funding in their second year of the programme too. Such students may be offered Institute Assistantship, as in the case of the M.Tech students, for a maximum of one year, provided they have a valid GATE score by that time and their case is considered favourably by the department.

For details about our department admission procedure, the candidates can visit our website: <http://www.iitk.ac.in/me/>.

